

## Long Term Monitoring of Vapor Barrier Performance Using Indoor Air Radon Gas Monitors

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**Background / Objectives:** Testing performed at the time Vapor Intrusion Mitigation Systems (VIMS) are installed can establish the effectiveness of those systems by measuring the soil gas to indoor air attenuation rates of Volatile Organic Compounds (VOCs) and/or naturally-occurring radon gas that are present in the subsurface. However, regulatory agencies often require long-term monitoring of VIMS to ensure they continue to provide a high level of protection to the building occupants over an extended period of time. Long term monitoring often involves the periodic collection and analysis of indoor air samples for VOCs. This type of monitoring is disruptive to the building occupants and often inconclusive due to the presence of VOC sources on the interiors of buildings, as well as in the ambient air. Monitoring of indoor air radon levels can provide an effective alternative for documenting the long-term performance of VIMS. The levels of naturally-occurring radon gas in the subsurface are high enough at most sites for attenuation rates to be established through the measurement of the radon levels in the soil gas, indoor air, and outdoor air. GeoKinetics uses radon data as the primary means of confirming vapor barrier performance after the construction, and prior to the occupancy, of a mitigated building.

The initial parent material for radon (Uranium 238) has a half-life of approximately 4.5 billion years and its immediate parent material (Radium 226) has a half-life of 1,590 years. As such, the level of radon gas in the subsurface beneath a building is likely to be relatively constant over time. As a result, the soil gas to indoor air attenuation rate for radon gas at a particular building can be monitored with a reasonable level of accuracy simply by tracking the radon level of the interior air.

**Approach / Activities:** A number of relatively inexpensive indoor air monitors are available that continuously measure and record radon levels with a resolution on the order of 0.2 pico-Curies per liter. These devices can store data for several months and that data can then be downloaded via a Bluetooth connection without the need for interior access. Radon gas monitoring protocol will be discussed in this presentation and typical monitoring results will be presented.

**Results / Lessons Learned:** The monitoring data generally indicates some diurnal and weather-induced variations in indoor air radon levels at most buildings. However, those variations tend to be relatively small at buildings where VIMS have been installed. Long term indoor air radon levels at mitigated buildings have been found to be stable with no indication of deteriorating vapor barrier performance to date.